

CRITICAL INFRASTRUCTURE INTERDEPENDENCIES

Impact of the September 11 Terrorist Attacks on the World Trade Center A Case Study



U.S. Department of Energy
Office of Critical Infrastructure Protection

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Introduction

The September 11, 2001, terrorist attacks on the World Trade Center and the Pentagon had far-reaching impacts on our nation's increasingly interdependent critical infrastructures—the electric power, natural gas and oil, telecommunications, water supply, transportation, banking and finance, and emergency and government services and systems that underpin every aspect of our lives. Many of the impacts associated with the attacks were local or regional in nature, such as the

The United States depends upon a complex, interdependent network of critical infrastructure information systems that are essential to our national and economic security.

— President George W. Bush
October 9, 2001

disruption of electric power and telecommunications systems in Lower Manhattan and the devastating impact on local emergency services personnel. Other impacts had national and international implications, such as the effects on global financial markets and commercial air transportation. The impacts also varied significantly in terms of time scale: many were immediate or occurred within hours of the attacks, while others took days or weeks to recognize.

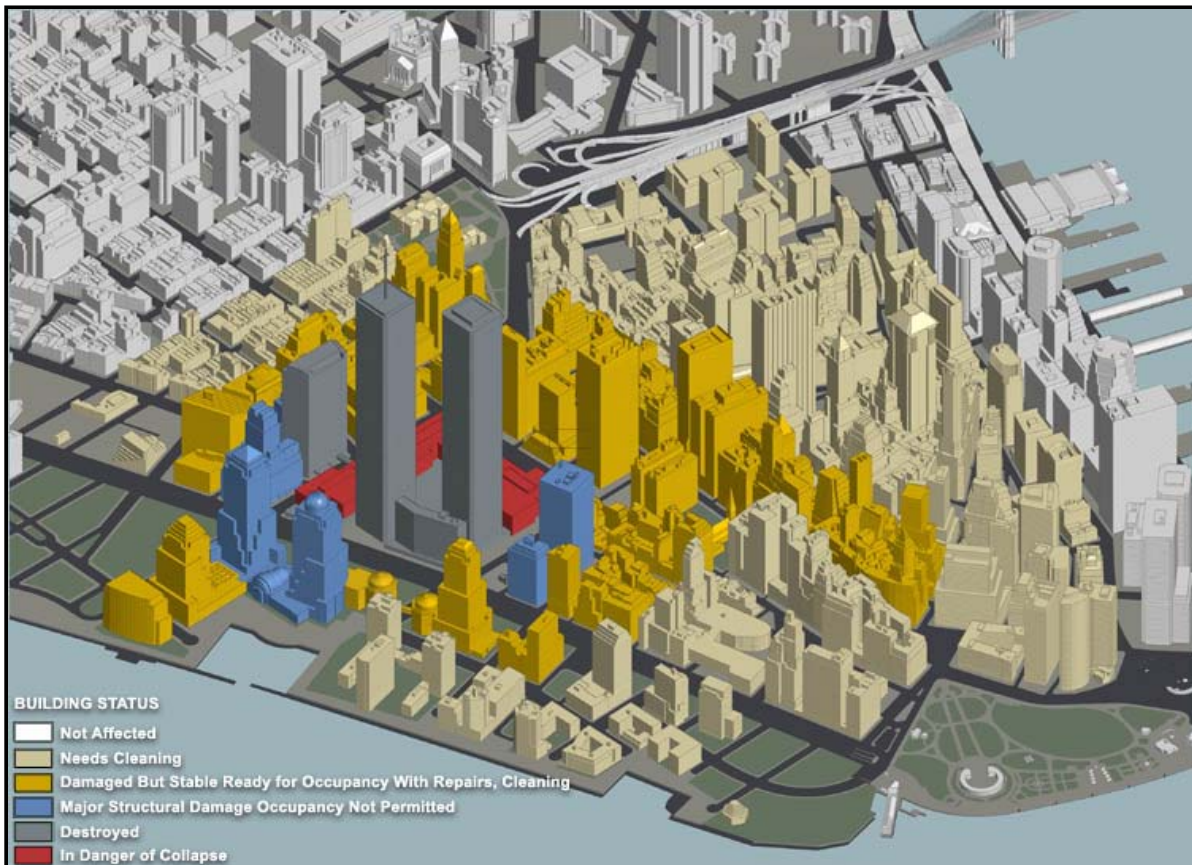
This summary report highlights some of the direct and indirect impacts of the New York City terrorist attacks, focusing in particular on infrastructure interdependencies, that is, the physical, cyber, geographic, and logical linkages among our nation's critical infrastructures. Direct physical impacts, as well as the subsequent cascading impacts on other infrastructures (i.e., effects that rippled within and among the critical infrastructures), are briefly described. Interdependencies that exacerbated repair and recovery efforts are also noted.

The Department of Commerce's Critical Infrastructure Assurance Office recently noted, "[t]he cascading fallout from the tragic events of September 11 graphically makes the business case for critical infrastructure protection. That the loss of telecommunications services can impede financial service transactions and delivery of electric power is no longer an exercise scenario. There can be no e-commerce without 'e' electricity. There can be no e-commerce without e-communications."

The information provided in this "quick-look" summary was gathered primarily from open-source materials, such as newspapers, magazines, journals, and web sites. Some information, although more limited in nature, was obtained through discussions with representatives from the various infrastructures. A more complete description of the impacts, along with detailed source material citations, is available in a companion report, which also includes information on the impacts due to the attack on the Pentagon.

Timeline of Terrorist Attacks, Tuesday, September 11, 2001

- 8:45 AM – American Flight 11 crashes into north tower of World Trade Center.
- 9:03 AM – United Flight 175 crashes into south tower of World Trade Center.
- 9:40 AM – American Flight 77 crashes into Pentagon. Trading on Wall Street halted.
- 9:49 AM – The Federal Aviation Administration bars aircraft takeoffs across the country. Flights in progress are instructed to land at the nearest airport. International flights in progress are told to land in Canada or return to the departure city.
- 9:50 AM – World Trade Center 2 – the south tower – collapses.
- 10:00 AM – United Flight 93 crashes 80 miles southeast of Pittsburgh.
- 10:29 AM – World Trade Center 1 – the north tower – collapses.
- 10:00 AM – 11:30 a.m. – Government buildings across nation are evacuated, including the Capitol and the White House, as authorities go on alert, tightening security at strategic facilities. The United Nations closes down. The Securities and Exchange Commission closes all U.S. financial markets for the day. New York City evacuates Lower Manhattan.
- 5:25 PM – World Trade Center 7 collapses.



1 Electric Power

Two Consolidated Edison (ConEd) substations that relayed electricity to a large area of Lower Manhattan were destroyed when the World Trade Center (WTC) buildings collapsed on them. To ensure continuity of response to the disaster, it was necessary to bring in generators and rig a temporary circuit of electrical cables to draw power from other nearby substations. The events of September 11 dramatically illustrate the importance of infrastructure interdependencies.



Key electric power infrastructure and interdependence issues are described briefly below.

- ❑ Transmission and distribution capabilities for Lower Manhattan were lost when buildings within the WTC complex collapsed. An around-the-clock effort was initiated to bring power back to the thousands of residents and businesses near Ground Zero.
- ❑ The impact to customers as the direct result of power outages was minimal because those individuals and businesses affected had already been evacuated to safer distances in the wake of the attack and collapse. Some larger customers, like the New York Stock Exchange, have their own temporary power source.
- ❑ ConEd dispatched more than 140 repair crews to the WTC area. Energy generators were brought in to help provide lighting for the rescue efforts.
- ❑ ConEd established new communications routes, as telecommunications losses affected the ability for many customers in the region to call existing ConEd emergency service numbers.
- ❑ By September 16, partial electricity service had been restored to most of Lower Manhattan. By September 17, more than 26 miles of new cable had been installed. By September 19, more than 33 miles of new cable had been installed, and service had been restored to all customers, except those in the immediate WTC area.
- ❑ Electrical service was restored to many “undamaged” customers within the first week. ConEd initially used surface streets to run transmission/distribution lines and temporary generators. Safety hazards as a result of water used to extinguish fires delayed reenergizing.
- ❑ The reductions in the demand for electric power in New York City were significant (greater than 200 MW from WTC 1 and 2 alone) and had an instant impact on market prices for electricity, both in New York City and upstate New York.

- ❑ In the days just prior to September 11, the New York Independent System Operator (NY ISO) electric demand averaged about 48,000 MW overall. The NY ISO had sufficient generation capacity on hand to meet this load. In the first few days following the attacks, the overall demand for electric power averaged about 45,000 MW.
- ❑ Security, especially at nuclear facilities, was heightened around the country immediately following the attacks. Electric power workforces were trimmed to essential personnel on September 11, and markets for power were closed.
- ❑ Although the restoration of the power market began on September 12, other business impacts continued (e.g., loss of Cantor Fitzgerald/TradeSpark staff due to the collapse of WTC 1; delay in Montana Power Company shareholders' meeting directly tied to the WTC and inability of vote counters to access offices in affected area; Securities and Exchange Commission ruling enabling power producers to repurchase shares).
- ❑ Redundancy of the electric grid and security of our nation's electric generating plants, especially nuclear plants, became critical issues in the wake of the attack.



2 Petroleum Fuels

Petroleum fuels provide a strong link between the United States and the global economy. In addition, other infrastructures, such as road and air transportation, are tied inextricably with petroleum fuels. Shortly after the September 11 attacks, crude oil prices reached a three-week low. Some of these reductions were caused by the slowing economy. A major drop in demand occurred, as airlines cut back their schedules.



Key petroleum fuels infrastructure and interdependence issues are described briefly below.

- ❑ Gasoline wholesalers and retailers quickly raised prices on the basis of fear that supplies would be disrupted following the WTC attacks. Panic caused by rumors of a pending gasoline shortage sent prices skyrocketing in Illinois, Michigan, Mississippi, Ohio, Oklahoma, and other states. The U.S. average cost of gasoline prior to September 11 was \$1.58 per gallon. Following the attacks, however, the cost in some areas had quickly escalated to \$2.91 to \$6.00 per gallon.
- ❑ In light of escalating gasoline costs, state prosecutors took swift legal action under consumer protection laws that prohibit unconscionable transactions. In addition, large oil companies lobbied distributors and retailers to avoid price gouging to stabilize prices.
- ❑ A number of on-going federal initiatives support the energy industry. Several new bills have been introduced to protect U.S. pipelines and other energy facilities, to increase the Strategic Petroleum Reserve, and to boost domestic oil production. The Federal Energy Regulatory Commission issued a policy statement to allow cost recovery for infrastructure protection measures.
- ❑ World oil prices rose in the immediate aftermath of the attacks and then fell, as the negative impacts on the U.S. and global economy became evident. On September 26, OPEC ministers met in Vienna to discuss market-stabilizing measures to keep oil prices in the range from \$22 to \$28 per barrel.
- ❑ Although it did not suffer physical damage as a result of the attacks, the U.S. refinery industry was impacted by those events. In the short term, refiners could not blend surplus jet fuel into other petroleum products (e.g., gasoline, heating oil). In the long term, however, the loss in the demand for jet fuel should not affect refining options because the industry can adjust operations to produce distillate, residual fuel oil, and gasoline rather than jet fuel.

3 Natural Gas

Following the September 11 attacks, natural gas delivery remained steady throughout the country. However, New York City experienced difficulties, as local distribution pipelines ruptured in Lower Manhattan. Energy markets were also seriously affected. Shortly after the attacks, natural gas prices dropped to the lowest level since April 1999; however, some of these reductions were caused by the slowing economy. The price of natural gas in the Western states dropped below \$1 per million Btu for the first time in three years over the weekend beginning September 21. Such price drops were not duplicated in other parts of the United States.



Key natural gas infrastructure and interdependence issues are described briefly below.

- ❑ Minor pipeline breaks were reported on September 11 and 12. ConEd was able to close valves to southern Manhattan and restrict natural gas flow to the WTC area. Reported natural gas leaks were handled quickly.
 - ❑ As a result of heightened security measures, liquefied natural gas shipments by ocean tanker were turned away from Boston Harbor.
 - ❑ Energy prices fell as the negative impacts on the U.S. and global economy became evident.
 - ❑ Initially, there was concern that the rubble from the towers may have covered pockets of natural gas from broken pipelines; however, recovery teams did not detect natural gas in any of their operations.
 - ❑ September is a non-peak period for natural gas in New York, so the system had extra capacity when the attacks occurred. In addition, New York's
- system is comprised of a high-pressure pipeline backbone with two cross connections such that when one portion experiences an increase in demand or loss of supply the system can accommodate the imbalance.
- ❑ Natural gas options and futures trading halted with the closure of the New York Mercantile Exchange (NYMEX). The NYMEX Henry Hub contract is a key mechanism in establishing natural gas pricing. Only spot market (current day) trading occurred until the NYMEX reopened.



4 Telecommunications

Telecommunications systems are the backbone of the information age. Nowhere is this fact more evident than in world financial and media centers like New York City. Each day, millions of financial transactions surge through the New York markets, supported by terabytes of information. For a leading global information and commercial center like Lower Manhattan, telecommunication is critically important. Prompt reopening of the New York Stock Exchange depended on the restoration of thousands of local phone lines and equipment physically destroyed during the attacks.

In the aftermath of the attacks on the World Trade Center, technology leaders presumed that the telecommunications system sustained “a brownout, not a blackout.” The industry was already working on cyber security, which was the number one concern of information technology (IT) managers in the 2001 Network World poll. The most significant concern as a result of the attacks seemed to be that budget cuts in IT needed to fund corporate programs related to the September 11 events would take money away from ongoing cyber-security activities. IT managers believe the cyberspace equivalent of the WTC attacks has yet to occur.



Key telecommunications infrastructure and interdependence issues are described briefly below.

- ❑ Local landline telephone outages occurred throughout Lower Manhattan. Verizon lost its West Street office and fiber optic facilities due to physical damage; other local Verizon offices experienced temporary outages triggered by power outages emanating from Lower Manhattan.
- ❑ New York City’s 911 emergency center remained operational throughout the incident. Cellular service and the Internet provided some backup communications options to wireline (see below).
- ❑ Local cellular service quickly became overloaded, and many calls in New York City on September 11 were blocked because demands for service reached 200%–400% of normal traffic loads.
- ❑ About 200,000 residential customers and 9,000–14,000 small businesses were without wireline voice or data service for two weeks or more. By October 11, however, 77% of these services had been restored.

- ❑ Large Manhattan-based businesses with well-tested, sound disaster recovery plans (or geographically distributed communications and computer networks) continued operations almost without interruption.
- ❑ The New York Stock Exchange reopened on September 17 after a priority restoration of 15,000 data lines.
- ❑ Cellular communications for government or emergency services were not given priority status, which hindered response by police, fire, and medical personnel.
- ❑ Domestic long-distance communications stayed up throughout the attacks, with network management controls throttling back in-bound traffic to New York City during the first day.
- ❑ News, commerce, and government web sites experienced loads up to twice the normal demand, resulting in slow or denied service for many hours after critical news events. However, broadcast and cable news sources were available nationwide when news web sites crashed, although some local broadcast radio antennae were destroyed in the

collapse. E-mail as a source of information stayed up throughout, and the Internet returned to normal behavior and performance after the first hour.




- ❑ Global voice communications were extremely overloaded, both to and from the United States as well as worldwide, with the percentage of calls completed falling as low as 10% for some countries.
- ❑ Massive amounts of information stored on and routed through local- and wide-area networks were lost, especially for businesses that did not follow proper backup procedures. Estimates to restore irretrievable information technology and communications range from \$8 billion to \$16 billion.

5 Air Transportation

Air transportation was one of the first infrastructures affected by the September 11 attacks. In the final analysis, air transportation may suffer the greatest impacts because of financial losses as a result of behavioral and operational changes in response to the use of hijacked planes in the attacks. The impacts on the air transportation system are already being propagated into other infrastructures and industries. The long-term effects of the attacks, including the direct and indirect impacts on air transport, are uncertain.

Key air transportation infrastructure and interdependence issues are described briefly below.

- ❑ Four commercial aircraft, along with crew (8 pilots and 25 flight attendants) and passengers, were lost.
 - ❑ All U.S. air transportation was halted for more than 24 hours, and commercial flights did not resume for three to four days. The national disruption of air traffic led to an increased demand on the road and railroad transportation infrastructures.
 - ❑ Upon resumption of air service, the number of flights was reduced significantly, and loads were only a small fraction of normal.
 - ❑ Increased security measures and the decline in travel reduced the number of flights nationwide and resulted in major economic impacts to the airline industry. These impacts have propagated into the travel and tourism sector and the overall U.S. and global economy.
 - ❑ More than 150,000 airline personnel and aircraft manufacturing personnel were laid off.
 - ❑ International passenger and freight flights were reduced as a result of increased security measures and a decline in travel.
- 
- ❑ Bankruptcy and the imminent closing of economically stressed/marginal airlines and subsidiaries (e.g., Midway, MetroJet, Sabena) resulted.
 - ❑ General aviation was severely restricted for several weeks following the attacks. Many small general aviation businesses suffered significant financial losses.
 - ❑ Major legislation has been enacted or proposed to improve airport and aircraft security. Initial activities have focused on employee background checks, passenger and baggage screening, and cockpit access.
 - ❑ Other legislation has been enacted or proposed to provide economic relief to the airline and general aviation industry.

6 Road Transportation

A strong and viable economy depends on an effective, operational road transportation system. On a daily basis, trucks use the U.S. highway system to deliver produce, perishables, and other agricultural products; medical supplies; manufactured goods; and other necessities throughout the nation, and people rely on roads to get to work or to travel to recreational spots. Following the World Trade Center attacks, transportation corridors within New York City were blockaded to allow entry by emergency responders and to ensure public protection and security. Road transportation was interrupted at border crossings due to enhanced security measures and became overloaded following the shutdown of the air transportation infrastructure, thereby affecting just-in-time delivery of manufacturing parts. In light of a national emergency of this magnitude, it is recognized that “transit” has a national security and defense component.

Key road transportation infrastructure and interdependence issues are described briefly below.

- ❑ All bridges and tunnels coming into Manhattan initially were closed to traffic, except for emergency response vehicles. Hundreds of packed city and private buses attempted to accommodate the demand for immediate transportation following the attack.
- ❑ The New York Port Authority Bus Terminal was shut down, affecting New York City and surrounding states. Greyhound ceased operations in the Northeast, and rail/subway systems were temporarily shut down.
- ❑ The availability of trucks, barges, and other cleanup equipment needed to dispose of approximately 1.2 million tons of debris became a key issue that potentially affected waste/garbage-handling capabilities of New York and surrounding areas.
- ❑ Air shipments were halted, which led to the use of alternative means (e.g., truck) to transport air cargo.
- ❑ The national disruption of air traffic led to an increased demand on roads, as

people searched for alternative means of travel. Public transit was used to evacuate travelers and workers from closed airports, as well as from downtown businesses and workplaces, greatly easing the burden on roadways.



- ❑ Some problems with hazardous materials licenses and permits were identified. The U.S. Department of Transportation released a safety alert outlining the need for extra security precautions. It may be necessary to impose additional safety and security requirements on road infrastructures and bus and truck operations.
- ❑ Extra security checks resulted in substantial delays at U.S. borders (note the 27-mile delay shown in the photo) with Canada and Mexico, affecting just-in-time delivery of manufactured parts.
- ❑ World oil prices rose in the immediate aftermath of the attacks and then fell, as the negative impacts on the U.S. and global economy became evident. Future OPEC actions on oil and gas prices may impact road transportation operations.



7 Rail Transportation

Like the road transportation infrastructure, rail transportation is an essential link in providing services for a strong economy. Manufacturers and other industries depend on a reliable network of tracks and tunnels to move goods (e.g., fuel, perishables and other agricultural products, building supplies), and thousands of commuters in cities across the nation use subways to reach their workplaces. Although the collapse of the World Trade Center initially curtailed this mode of transportation, once resumed, rail transportation significantly eased the backlog of stranded travelers and helped provide supplies needed for rescue operations.



Key rail transportation infrastructure and interdependence issues are described briefly below.

- ❑ Three subway stations below Ground Zero were heavily damaged, and subway service was shut down. Some flooding and electrical problems also plagued these stations. In the following days, the remainder of the subway system became operational, although frequent delays, or brief shutdowns, occurred.
- ❑ Penn Station and Grand Central Station initially were closed, and train traffic to and from the city was halted.
- ❑ The Port Authority Trans-Hudson (PATH) stationmaster took quick action when an inbound Newark train arrived at a station under Ground Zero. Passengers were ordered to remain on-board, people waiting at the station were boarded exclusive of destination, and the train departed safely to Jersey City. Another train was directed to return to evacuate PATH employees.
- ❑ Amtrak service was suspended nationwide within a few minutes of the tragedy for a top-to-bottom security sweep. Once determined to be safe, Amtrak used its assets to move travelers; provide transportation to families, emergency workers, and public officials; and carry relief supplies and carloads of U.S. mail.
- ❑ The Amtrak Northeast Corridor service carried essential medical supplies (e.g., blood, plasma), firefighters, and other critical relief assets to the New York site.
- ❑ Insurers have notified Association of American Railroads member freight railroads that liability premiums will increase substantially and that some coverage may be eliminated.
- ❑ The demand for railroad transportation, both for passengers and for freight, increased as a result of the disruption of air services.

- ❑ World oil prices rose in the immediate aftermath of the attacks and then fell, as the negative impacts on the U.S. and global economy became evident. Future OPEC actions on oil and gas prices might impact rail transportation operations.
- ❑ Railroad transport of hazardous materials may be subject to additional safety and security requirements. Additional safety and security measures may also be imposed on rail passenger station operations.



8 Water Transportation

Water transportation provides a strong link between the U.S. and the global economy. Crude oil, natural gas, ores and minerals, chemicals, lumber, and manufactured goods are shipped and received via river barges, cargo ships, and ocean-going tankers. Cruise ships are significant assets of the entertainment and hospitality industries and, in some cities such as New York, watercraft (e.g., barges, ferries) moves materials, vehicles, and people.



Key water infrastructure and interdependence issues are described briefly below.

- ❑ The debris from the World Trade Center site—1.2 million tons—is being transported using a combination of trucks and barges.
- ❑ Two new port facilities were constructed in Manhattan to supplement the two existing trash transfer stations—a barge port on the Hudson River at 59th Street and one on Hamilton Avenue in Red Hook, Brooklyn—to help in the transfer of debris to Fresh Kills Landfill on Staten Island.
- ❑ Ferries augmented buses and subways to get people home immediately following the WTC attack.
- ❑ Implementation of increased security at New York City harbor facilities has diverted some necessary emergency services and police efforts.
- ❑ The U.S. Coast Guard increased the advance notice required of merchant marine ships with international cargos and crews before entering U.S. waters and ports from 24 to 96 hours.
- ❑ The U.S. Coast Guard instituted a ban on tanker shipments of liquefied natural gas into Boston Harbor.
- ❑ The attacks caused industries to take a careful look at their vulnerabilities. For example, petroleum refineries have beefed up security at plant gates and at docks where some coastal refineries receive crude oil.
- ❑ Refineries and chemical companies along the Houston Ship Channel continued to operate, but with caution and additional security measures.

- ❑ Newly implemented procedures for handling cruise ships has significantly increased the security workload of shipboard personnel and port facilities. These new procedures have restricted access to the ships; required detailed monitoring of materials, consumable supplies, and service personnel onboard; and necessitated 100% screening of all passenger baggage.
- ❑ New York City firefighters evacuated wounded to New Jersey via watercraft.



9 Water and Wastewater

The water and wastewater infrastructure is critical to normal functioning of industry, business, firefighting, agriculture, and residential activities. Water must be (1) available on demand, (2) delivered at sufficient pressure, and (3) safe for use. Actions that affect any of these three factors could be debilitating for the infrastructure. As a result of the World Trade Center attacks, a number of concerns (e.g., safety) have arisen.

Key water and wastewater infrastructure and interdependence issues are described briefly below.

- ❑ The terrorist attack on the WTC did not adversely affect drinking water supplies, according to government agencies. The EPA conducted extensive sampling of water, river sediments, and drinking water, analyzing them for the presence of asbestos, radiation, mercury and other metals, pesticides, PCBs, or health-threatening bacteria. Results showed no evidence of significant health hazards to the public in the New York Metropolitan area.
- ❑ Cities and states are reassessing the safety of their drinking water—probing for weaknesses and shoring up defenses. Utility companies have posted armed guards around water treatment plants, installed tamperproof manhole covers in sidewalks, and blocked roads around reservoirs.
- ❑ The Port Authority planned to “cork” the tunnels at Exchange Place with a pair of giant concrete plugs.
- ❑ The FBI advised U.S. drinking water suppliers to be alert and exercise caution to guard against possible sabotage in the wake of the recent terrorist attacks. The FBI believes that U.S. water supplies are a “logical target for a possible terrorist attack, ...”
- ❑ Congress is considering the use of local law enforcement personnel to tighten security around the Department of the Interior’s 58 hydroelectric dams and 348 reservoirs, which represent the nation’s largest supplier of water.
- ❑ The EPA has received up to \$83 million from FEMA to support the Agency’s involvement in cleanup activities and monitoring of environmental conditions.
- ❑ Attempts to dig out the WTC basement without taking proper precautions could cause the walls to shift or rupture, leading to flooding and instability in nearby buildings.
- ❑ Water, most likely from fire hoses, rain, and broken water pipes, is flowing through the Port Authority Trans-Hudson (PATH) tubes to New Jersey.



- ❑ Plans for investments in water and wastewater treatment facilities upgrades or replacement should be reviewed to address potential vulnerabilities to terrorist threats.
- ❑ In response to concerns about terrorism, the nation's water system operators want Congress to appropriate \$5 billion to protect drinking water and wastewater plants. They also want \$155 million—a 62-fold increase over current appropriations—from the EPA for security planning.



10 Banking and Finance

Lower Manhattan is one of the greatest financial centers in the world, and by extension the term “Wall Street” has become synonymous with U.S. financial interests. The Wall Street area, which extends several blocks north of the World Trade Center and south to Battery Park, is home to the New York and American Stock Exchanges, commodity exchanges, many commercial and investment banks, and financial law firms. The attack and collapse of the WTC resulted in closure of the stock and bond markets, cancellation of a Treasury bond auction, and general uncertainty about the markets and financial transactions. Prominent firms lost key personnel and systems, which affected commercial activities and influenced other infrastructures and transactions throughout the United States.

Key banking and finance infrastructure and interdependence issues are described briefly below.

- ❑ Communication and electric power were interrupted at trading centers, resulting in closure of stock and bond markets and cancellation of a Treasury bond auction.
- ❑ Layoffs and bankruptcies, beginning with the airlines and spreading to related sectors, led to a significant increase in unemployment, which further eroded consumer confidence.
- ❑ The value of foreign markets and the dollar dropped, while oil and gold prices increased, reflecting loss of investor confidence and uncertainty about the condition of markets and the payment system.
- ❑ A decline in consumer confidence resulted, which was further fueled by job reductions and layoffs. The subsequent decline in consumer demand is expected to precipitate an economic recession in North America and a global economic downturn.
- ❑ Swift action to ensure the flow of capital averted a potentially catastrophic payment crisis. Grants and guarantees issued or endorsed by the Federal Reserve and Congress were initiated on September 11.



- ❑ Shipping delays caused by the attack and subsequent security measures could result in longer-term effects on the flow of manufacturers' supplies and products, especially manufacturers that rely on easy flow across international borders.
- ❑ Change in stock buy-back provisions, adopted by the Securities and Exchange Commission to provide a market for stocks prior to reopening of the New York Stock Exchange, could lead to changes in investor control.
- ❑ Changed risk perception could lead to long-term shifts in manufacturers' inventories.
- ❑ About \$200 million of gold and silver were buried under a building at the WTC site and had to be removed to complete demolition activities.



11 Emergency Services

The attack on the World Trade Center placed extreme demands on local emergency services. However, at no time have there been any indications that emergency services were “overwhelmed.” The excellent response is attributed to the fact that the incident occurred in a large metropolitan area with robust mutual aid networks where there has been extensive planning and preparedness to handle catastrophic emergencies. Triage and emergency medical facilities were quickly set up to treat large numbers of casualties, but there were very few surviving casualties.

Emergency, recovery, and government services were well prepared and responded quickly. Medium- and long-term impacts, however, such as psychological trauma to first responders and emergency workers, loss of firefighters and police, political skirmishes, and waste and fraud that have plagued large disaster recovery efforts in the past will undoubtedly impact the recovery of other infrastructures.

Key emergency services infrastructure and interdependence issues are described briefly below.



- ❑ The attack on the WTC dramatically affected local first responders and metropolitan emergency services: 343 firefighters were missing or dead (about 3% of New York City’s uniformed firefighters) and more than 40 police officers were missing.
- ❑ Command and control service was disabled due to the loss of the Incident Command Post following the collapse of the WTC towers and loss of the emergency operations center (EOC) when Building 7 of the WTC collapsed.
- ❑ Instability and impediments (debris, heat, and fires) on the scene hindered early search-and-rescue efforts.

- ❑ Rescue and recovery efforts were hampered by responder fatigue, psychological impacts, and concerns for safety to prevent additional injuries.



- ❑ Emergency facilities (triage shelters, Incident Command, and an alternate EOC) were quickly set up as a direct result of effective planning.



- ❑ Mutual aid, state resources (i.e., National Guard), and federal assistance (i.e., FEMA, Health and Human Services) quickly augmented local emergency resources.
- ❑ Improved support systems, including interagency coordination, expedited contracts, and the creative New York metropolitan resources facilitated the response and recovery efforts.

12 Government Services

Local government services are initially strained when a terrorist incident occurs, and the effects accumulate with time. Most U.S. airports and many other public services and facilities (water and transportation systems, wastewater treatment plants, ports, and emergency medical response assets) are operated by municipal or regional authorities. Although most local governments have made significant efforts in disaster preparedness, no local government can afford to maintain the reserve of personnel and equipment needed to respond to a disaster of the magnitude experienced in New York City on September 11.

Regional and national support becomes essential in such circumstances.

New York City experienced heavy losses in revenue from all forms of businesses and services as a result of the disaster. This followed an enormous demand for the city to provide many services despite the fact that loss of personnel and equipment was diminishing the city's capacity to respond. Other demands on the city's services followed quickly after the tragedy, as the stress and trauma suffered by the public led to looting and crimes against persons. The effect on family activities was especially severe because families avoided parks, amusement centers, and restaurants, further increasing the loss of local taxes and fees. These aftereffects were shared by U.S. cities far from New York.



Key government services infrastructure and interdependence issues are described briefly below.

- ❑ Eight primary schools were evacuated and are closed during restoration, disrupting the education of 9,000 students.
- ❑ Worker compensation costs are expected to exceed \$1.3 billion, and up to 700,000 jobs in the metropolitan area will be disrupted in some way. The State of New York has secured \$25 million in aid to provide temporary jobs for those affected.
- ❑ New York City will lose \$1.3 billion to \$3 billion in local tax revenue as a result of lost business and lower real estate prices.
- ❑ The attack displaced 20% of the city's lawyers, and only 10% of the normal caseload can be heard because local, state, and federal courts were located near Ground Zero.
- ❑ Primary elections were canceled and rescheduled.

- ❑ State tax receipts have declined due to reduced business travel and downturns in economic activity. Unemployment compensation, health, and other worker benefits are affecting state budgets. States with constitutionally mandated balanced budgets might need to cut benefits for eligible recipients. Estimates of the shortfalls range from \$10 million to \$3 billion.
- ❑ Nationwide, assets have been diverted from funding normal services to preparing for terrorist attacks. Demands for public safety operations have increased, and some services (building permitting and inspections) have been delayed due to new restrictions on access to records and files because of heightened security.



Aftermath

In addition to the direct and indirect problems affecting electric power, telecommunications, water, financial markets, emergency services, and other critical infrastructures described in this summary report, the attacks on the World Trade Center have led to a number of common actions by (or affecting) public and private sector infrastructure service providers.

- ❑ Security and surveillance measures at major facilities, both public and private, have been heightened across the nation. The cost of increased security is expected to significantly affect many industries.
- ❑ Information formerly available through public-access channels such as the Internet has been removed from those sites.
- ❑ The economy suffered immediate effects in the wake of the attacks. For example, the cost of energy declined, markets closed, and airline service was suspended. Longer-term effects, such as layoffs, decline in consumer confidence, and financial losses, continue to fuel a downturn in domestic and global economic activity.
- ❑ Government facilities and private industry are assessing potential mitigative measures to address vulnerabilities, including those related to interdependencies.
- ❑ Insurance (e.g., liability, worker compensation) premiums are expected to increase, which will affect the cost of doing business nationally and internationally.
- ❑ Legislative initiatives are underway to provide government assistance and promote “best practices.”
- ❑ Communities are evaluating and, as necessary, revising or updating emergency plans to deal with the new threat environment.

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